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UTILIZATION OF PROGRAMMED INSTRUCTION IN NAVAL SHIPBOARD TRAINING PROGRAMS

DONALD L. EDWARDS

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UTILIZATION OF PROGRAMMED INSTRUCTION IN NAVAL SHIPBOARD TRAINING PROGRAMS

* * * * *

Donald L. Edwards

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UTILIZATION OF PROGRAMMED INSTRUCTION

IN NAVAL SHIPBOARD TRAINING PROGRAMS

by

Donald L. Edwards

Lieutenant Commander, United States Navy

Submitted in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE
IN
NAVAL MANAGEMENT

United States Naval Postgraduate School
Monterey, California

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by

Donald L. Edwards

This work is accepted as fulfilling

the research requirements for the degree of

MASTER OF SCIENCE

IN

NAVAL MANAGEMENT

from the

United States Naval Postgraduate School

ABSTRACT

The technique of programmed instruction as a tool of learning has made phenomenal advances during the past few years. A great deal has been written about this instructional technique, its advantages and its limitations.

This paper attempts to answer the question, "Can programmed instruction be of value as a tool in the shipboard training and education program?" A general discussion of basic theories of learning, history and development of programmed instruction, and types of programs and machines is presented. This forms the basis for a discussion of this learning technique and its application in the fleet. A chronological review of developments in the Navy and current utilization in the fleet is given.

It is concluded that programmed instruction can make a major contribution toward achieving a more efficient shipboard training and education program. Several areas of possible application are suggested.

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I

INTRODUCTION

The purpose of this study is an attempt to determine the application of programmed instruction in naval shipboard training programs. An extensive discussion of the principles of learning, the variety of theoretical and practical problems, and the various programming concepts and techniques associated with the area of programmed instruction will not be attempted in this study. Before discussing the development of programmed instruction in the Navy, a general discussion of basic theories of learning, history and development of programmed instruction, and types of programs and machines will be given in order to form a basis on which to discuss its application in the Fleet.

The major portion of this research has been limited to the development and utilization of programmed learning aboard naval ships. A study of the entire Navy-wide program is beyond the scope of this paper. It is not intended to disregard or eliminate the value of programmed instruction in other areas of naval training. Considerable research has been made and is presently being conducted in the use of programmed instruction in various types of training areas and facilities.

Fleet Training Commands, some type training commands, Bureau of Naval Personnel, Naval Research Centers, USAFI, U. S. Naval Training Facilities, and a number of civilian publishers of programmed instruction devices were contacted in an effort to determine the past, present, and anticipated use of programmed instruction in the Fleet.

While it is the Navy's policy to strongly encourage the prospective

recruit to study math and science, stay in high school and graduate, and go on to college if possible; the fact remains that the average recruit who joins the Navy today does not have a high school diploma.[1] Many of these men have had little more than an eighth grade education. Only through a sound program of training and education, using every available technique, can we produce men who will rise to the challenge of the highly technical revolutionary environment of today's Navy.

While still a member of the U. S. Senate, the late John F. Kennedy made the statement,

> ...and what we need more than atomic power, or air power, or financial, industrial, or even manpower, is brain power.

This statement is becoming more and more applicable to the Navy as new technical developments are being made in all fields. It is becoming increasingly important that our ships and shore stations be manned by mentally alert, well educated individuals.

In a letter to the Chief of Naval Personnel, the Chief of Naval Operations stated that it has always been the philosophy of the Navy that one of the responsibilities of a commanding officer is to train his personnel. I would expand this to include the education of his personnel. He goes on to say it has been presumed that a significant portion of this training must be accomplished at the command, i.e., on the job. This philosophy and presumption are valid for today's Navy. Current shortages of personnel, complexity of equipment, and tempo of fleet operations, although appearing to militate against such training, in reality make more pressing and more critical the requirement for

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[1] Tom Compere (ed.), The Navy Blue, v. 1, (Indianapolis: Bobbs-Merrill Co., Inc., 1960), p. 140.

effective and extensive on-the-job training. Accomplishment of training by means of schools and courses external to the command is recognized as an essential element of the Navy's total training effort; none the less, capability to train on board the command to the maximum extent possible must be developed.[2]

If programmed instruction can be of a beneficial nature in any phase of this training and education, then it deserves thorough investigation and immediate application where feasible. It is not, nor was it intended to be a panacea or a replacement for all other training techniques now being used. Rather, it is one more tool to be used in developing a more efficient program. It will be helpful in many training situations, and it will be worthless in others, it will be better than some of the training now being provided; it will also be worse than some of it. The point is, this is a revolution in training which has great significance and deserves serious consideration in any training or educational situation.

It would hardly be possible for the development which has occurred during the past few years if programmed learning were not soundly based on accepted educational and learning principles. The basic principles on which program construction rests have been tested in both field and laboratory by industry, educational institutions, and government. Pragmatically, they have proved sound. Students do learn, and learn efficiently, when they make use of programmed materials.[3]

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[2]CNO ltr Op-03T3/mln, Ser: 26P03T of 25 March 1963.

[3]Edward B. Fry, Teaching Machines and Programmed Instruction, (New York: McGraw-Hill Book Co., Inc., 1963), p. 183.

It is the aim of this paper to show there are areas of immediate utilization possibilities and numerous applications for future development of programmed instruction in the naval shipboard training and education program.

II

DEVELOPMENT OF PROGRAMMED INSTRUCTION

1. Basic learning theory.

Programmed learning has its origin among educational psychologists primarily concerned with learning theory. The basic principles and concepts of program construction rests mainly on learning theory. A brief outline of the more basic theories, therefore, is appropriate before discussing the development of programmed instruction.

Learning theories in general fall into two major families; stimulus-response (S-R) theories and cognitive (S-S) theories, however, not all theories belong to these two families. The most common or well-known stimulus-response theories include theories of Thorndike, Guthrie, Skinner, and Hull. The cognitive theories include at least those of Tolman, the classical gestalt psychologists, and Lewin's field theory. While Lewin was originally of the gestalt group, his findings and influence on present day theory were such that he is normally considered separate.[4]

The basis of Thorndike's theory was that of association between sense impressions and impulses to action. This association came to be known as a "connection." Thorndike's "connectionism" is the original stimulus-response theory of learning. Basically his theory was all along that of automatic strengthening of specific connections--directly, without intervening ideas or conscious influences.[5]

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[4]Ernest R. Helgard, <u>Theories of Learning</u> (second edition; New York: Appleton-Century-Crofts, Inc., 1956), chapter one.

[5]<u>Ibid</u>., chapter two.

Guthrie's contiguous conditioning theory, while similar to Thorndike's in that it is also a stimulus-response theory, has several marked differences. Guthrie has placed much stress upon conditioning as the characteristic form of learning.[6]

Skinner's operant conditioning theory, while classified in the stimulus-response family, breaks with the conventional theories which enforce the dictum "no stimulus, no response." Skinner proposed that two classes of response can be distinguished, a class of elicited responses and a class of emitted responses. The elicited responses are classified as respondents and the emitted responses as operants. Related to the two types of responses, Skinner has designated two types of conditioning. The conditioning of respondent behavior is assigned to Type S because reinforcement is correlated with stimuli, while Type R is assigned to conditioning of operant behavior because reinforcement is correlated with response.[7]

Hull's systematic behavior theory is unified around the conception that learning takes place only as a consequence of reinforcement. However, his theory is not a highly integrated one, so no one concept is truly central to it.[8]

Tolman's theory of sign learning (sign-significate) contends that the learner is following signs to a goal, is learning his way about, is following sort of a map---in other words, is learning not movements but

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[6] Ibid., chapter three.

[7] Ibid., chapter four.

[8] Ibid., chapter five.

meanings. The law of exercise is accepted in the sense of the frequency with which the sign, the significate, and the behavioristic relation between the two, have been presented. Exercise is not the cause of the initial selection of the right response. Mere frequency without belonging does not establish a connection. After a response has been learned, over exercise tends to fix it, making it unduly resistant to change.[9]

The Gestalt theory, while not solely a theory of learning, is considered as one of the leading cognitive theories. The general point of view of this theory is expressed in the statement that the laws of organization apply equally to preception and to learning. It is implied that a learner acts as intelligently as he can under the circumstances which confront him, so that insightful solution of problems is the typical solution.[10]

These theories are not all exhaustive. They are generally considered to be the basic ones and those on which programmed learning is based. Sheffield, Miller, Mowrer, Spence, Seward, Harlow, and Hebb, are just a few of the many psychologists of the last twenty years who are continuing in the study, experimentation, and development of learning theory.

All these theories have several common points. 1) Some sort of stimulus is necessary to which the learner must make some sort of response. 2) Small increments are superior in the learning process. 3) Reinforcement of the response leads to better learning. 4) Immediate feedback, or results of response strengthens the learning process. A point of controversy which accounts for the two approaches to

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[9] Ibid., chapter six.

[10] Ibid., chapter seven.

programming discussed later, is whether an initial correct response is more conducive to learning than an incorrect response followed by a series of trial and error attempts until finally arriving at the correct one.

2. Development.

Teaching machines and programmed instruction represent new methods of education that have attracted a considerable amount of interest in the past few years. Actually, these new methods consist of a collection of psychologically sound teaching principles that have been known for some time; their unique characteristics are found in the coordinated application which provided new insights into the teaching and learning process.[11]

First an explanation of a few terms is appropriate. Programmed instruction was described initially by the term "teaching machine." This term was fairly universal in reference to programmed instruction until the early 1950's. A growing recognition of the paramount role of the material or program which the machine manipulates gave rise to phrases such as automated instruction, programmed learning, self-tutoring, automated learning and many other similar terms. There is even differing opinions concerning the proper spelling of the word programmed. Many feel that it should be spelled with a single "m". It is important to note that all the terms really refer to the same thing: namely, a system which presents to the student material to be learned. This

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[11]Fry, op. cit., p. vii.

material is presented in a standardized fashion, taking advantage of the principles of immediate and positive reinforcement. The term programmed instruction will be used to include the entire system of presentation including the program along with any device used in conjunction with it. It should be remembered that the program may or may not be presented with the aid of a machine.

Though this new phenomenon of education really began as early as 1926 with pioneer work by Professor S. L. Pressey,[12] most of the research and development in programmed instruction has occurred in the past few years. This recent development, beginning with the shift of emphasis from the hardware to the program in the early 1950's, has been brought about largely as the result of the studies of Professor Pressey, Dr. B. F. Skinner, Professor of Psychology at Harvard University, and Dr. Norman Crowder.

During the first few years of development, programmed learning was aimed primarily at schools and the academic world. Industrial, government, and military organizations all began to look at its possibilities late in 1959 and the early part of 1960. IBM and Eastman Kodak are considered to be the first companies to apply programmed instruction in their training programs, both beginning research the latter part of 1959. The Air Force and Navy also initiated research projects about this same time. The use of programmed instruction spread in the industrial world very rapidly during the past few years. Development has been slower in the military, however, the Air Force

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[12] Professor of Psychology at Ohio State University. Commonly referred to as the father of programmed instruction.

appears to be doing considerably more research and utilizing this new technique to a greater extent than the other services.

The rapid development of programmed instruction is indicated by the growth of producers and the increase of machines and programs available since 1958, (Figure 1). Fry, Bryan, and Rigney published a report in October, 1960, listing eleven machines produced, of which only five were actually in production at that time as far as could be ascertained. Another report by Sturwold published in Audio-Visual Instruction in April, 1961, listed 36 machines, of which only 15 were in actual production at the time. In the report of a survey conducted by Finn and Perrin, published in January, 1962, 83 machines were found in various stages of development, of which 45 were in limited or full production. It was estimated that approximately 300 programs were commercially available or in preparation by the end of 1961, and this number would more than double in 1962.[13] In a programs guide for 1962 published by the U. S. Department of Health, Education, and Welfare, Office of Education, 122 "guaranteed" programs were listed as being available for the 1962-63 school year. (18)

3. The program.

The subject matter to be taught by programmed instruction is composed into a program. The program may be of several physical forms. Some of the more common ones are books (bound or spiral), tapes or strips of paper, microfilmed slides, and auditory material to be used

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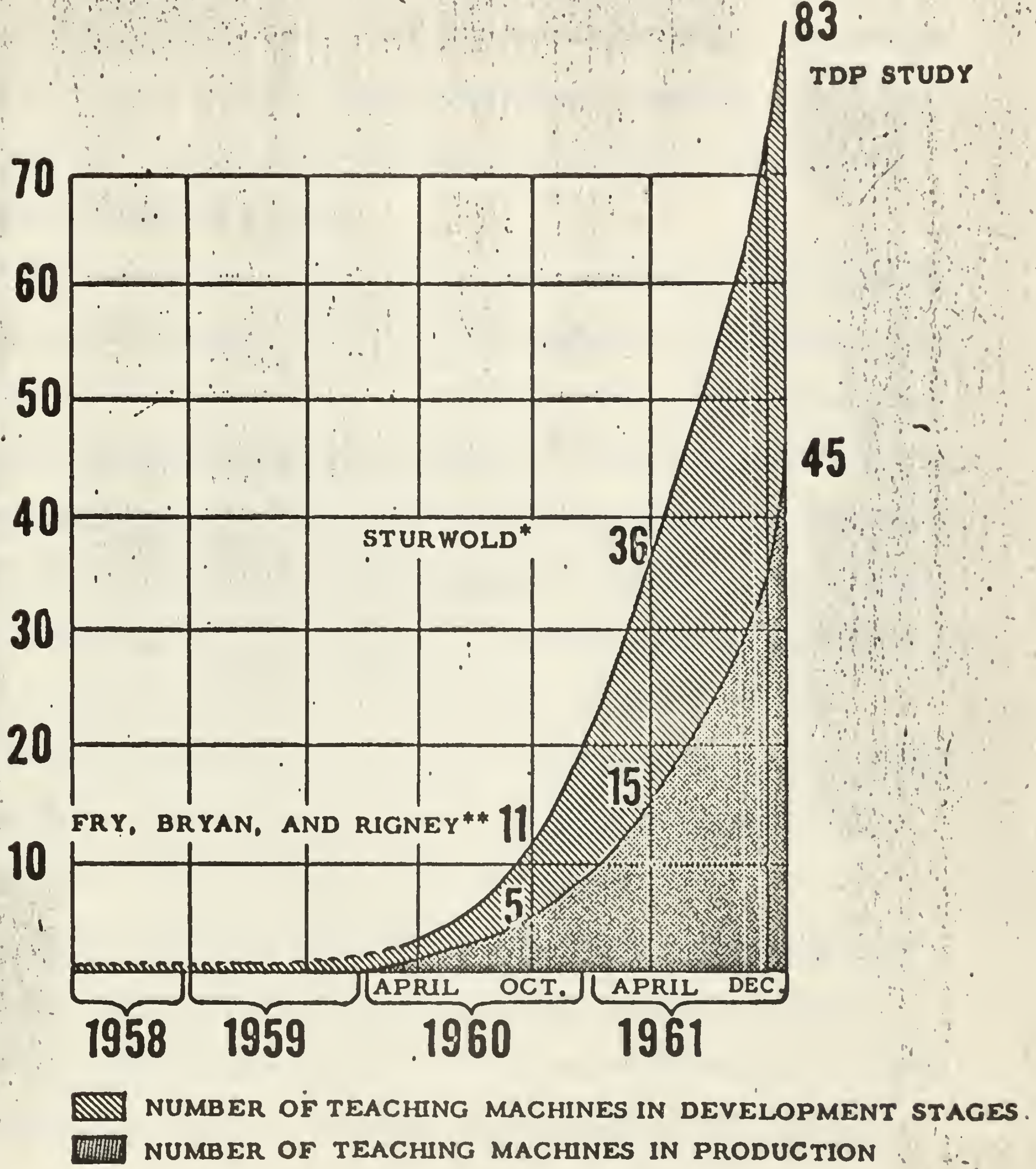
[13] James D. Finn and Donald G. Perrin, Teaching Machines and Programmed Learning, 1962: A Survey of the Industry, NEA Occasional Paper No. 3, (National Education Association, 1962), p. 32.

TEACHING MACHINES FOR THE SCHOOL MARKET



* Sturwold, Virginia G., "Sources of Self Instructional Devices", Audiovisual Instruction, Vol. 6 No. 4 (April 1961), pp 144-45.

** Fry, Bryan, and Rigney, "Teaching Machines: an annotated bibliography", Audio Visual Communication Review, Vol. 8 No. 2 (October 1960), pp 75-79.

(Figure 1)

with a tape recorder. It consists of a series of items, referred to as frames. A frame is a unit of the program that requires a response of a student. The material in the frame builds cumulatively. The programs are normally built in small steps from simple to complex. The information required to answer a given item is contained in that item or in preceding items, or in both.

At the present time there are two basic approaches to programming. The first is the straight line or linear program as developed and used by Skinner and his associates. The second is the so-called branching or intrinsic program developed by Crowder.[14] The basic differences in the two programming techniques are the type of response and the degree of probability desired for a correct initial response by the student. Skinner strives in the linear program to minimize any possibility of an incorrect response, and uses the constructed or fill-in answer. Crowder, insisting that the learner must be given a chance to be wrong, requires him to choose from a number of possible responses already provided in the text (multiple-choice type answer).[15]

The linear program is composed of small steps leading logically through the subject matter from topic to topic in such a way as to maximize the probability of success. A series of frames may be viewed as a sequence of stimuli or stimulus elements sharing some elements

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[14] E. J. Green, The Learning Process and Programmed Instruction, (New York: Holt, Rinehart and Winston, 1962), p. 117-130.

[15] Theodore B. Dolmatch, Elizabeth Marting, and Robert E. Finley, (eds.), Revolution in Training: Programed Instruction in Industry, (New York: American Management Association, 1962), p. 15.

from frame to frame. One may regard learning as the conditioning of behaviors to the elements within a frame. Through reinforcement, the probability of a correct response is increased to those elements within a specific frame; one then moves on to the next frame. The probability of response to the next frame is higher than it otherwise would be because some intercept elements are shared with the previous frame or frames, to which the response has already been conditioned. Thus, the learner proceeds from the known to the unknown. The continuing process of differentiation is indicated by chains of discriminative stimuli overlapping with one another in terms of the elements shared between successive frames or discriminative stimuli.[16] This type of program is best suited for use with the more simple type devices used in programmed instruction, therefore probably the most applicable to shipboard utilization.

In the branching program, the student is presented with a problem and with several alternative answers, one of which is correct. When the student chooses an answer he is instructed to move to a specified frame. This frame then tells him if his answer was incorrect and if so explains why it was incorrect. The frame then may return the student to the original item which he had answered incorrectly for another trial, or it may direct him through a sub-program, further instructing him in the basic knowledge presumed to be necessary for the item he had answered incorrectly. In either case, the student is eventually returned to the missed item which he then, presumably answers correctly. If he again chooses an incorrect alternative, a similar process is

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[16] Green, loc. cit.

followed. Ultimately, he is returned to the missed item and answers it correctly. He is then directed to the next frame in the program where the same process may be repeated should he answer that item incorrectly.

Both the linear program and the branching program lend themselves to publication in the form of books. Several books have been published using the linear format. Branching programs are published in the form of scrambled textbooks. The scrambled textbook arranges the frames and alternative answers to frames in such a way that the student is directed to search through the book to proceed to the next step. It does not move sequentially, page by page, as does the linear program.[17]

These two program forms should not be regarded as exhaustive. New and different forms are likely to be developed as the technique and knowledge of programming advances, causing both of these existing forms to be rejected. Both programs have weaknesses. The linear program may often be unstimulating and possibly even an insult to the intelligence of the brighter student. If the program provides nothing more than generalized busy work, with the learner actually being guided to the correct answer, little reinforcement will be derived. On the other hand, many learning theories reject the sheer existence of error for the accomplishment of any educational objective. Presenting three times as much erroneous material as correct material to the student raises the likelihood that much of this erroneous material will ultimately

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[17] Ibid.

be retained instead of the correct associations that the student should establish.[18]

Similar criticism could, at times, be made of conventional instruction and textbooks. Often a book which is unstimulating to a brighter student is a real challenge to a slower person. The program must be selected to meet the needs of the situation. The objectives of the program must be established clearly at the very beginning of construction, for they guide the selection of principles and techniques on which the program is built. One of the basic advantages of programmed instruction is that of individual development, each student moving at his own level and at his own speed.

4. The machine.

Teaching machines date back to about 1866 with Holcyon Skinner's invention of an apparatus for teaching spelling. Very little more was heard of them until the early 1920's when S. L. Pressey developed a simple device for automatic testing of intelligence. Later in 1926 he devised an apparatus about the size of a portable typewriter that presented to the user a series of multiple-choice questions. This device is the forerunner of the modern teaching machine. For many years the teaching machine attracted little attention. The devices developed between 1920 and 1945 were basically in the area of testing, however, built around the same basic elements of programmed instruction of today: namely, stimulus, response, and immediate feedback.[19]

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[18] Ibid.

[19] Alfred A. Beltran (comp.), Automated Teaching Machines: An Annotated Bibliography, (Sunnyvale: Lockheed Aircraft Corporation, 1960).

The phrase teaching machine, which is defined as a device used to instruct through the presentation of material, could include textbooks, training film, tapes or recordings, film strip, mock-ups, link trainers, or most any other type of training device. The device used in programmed instruction has several specific criteria which must be met. 1) It is individualized, one person learns at a time, using a separate device. 2) The device presents material to be learned in minimal increments. 3) The material is rigorously ordered with it. 4) The learner is required to make an overt response to the material. 5) The learner progresses at his own pace. 6) The learner receives instantaneous results of his answer.

There have been scores of machines developed and in use at the present time. These machines range in cost from a few dollars up to several thousand. Their size varies from a small textbook to a large, complex and elaborate electronic machine. I shall not attempt an exhaustive survey of all the machines but mention only a few examples which are considered adequate for shipboard use, both in cost and size. An excellent description as well as photos of the machines in production up to January 1962, along with available programs and a list of suppliers of programs and devices is given in a survey and report made by Perrin and Finn. (10)

Storage and ease of handling are two very important features which must be considered when selecting a program and device to be used aboard ship. Programs which are made up in booklet form or the programmed text are preferable to those using individual loose leaf paper. The holding and masking devices used with the former are much more adaptable to

shipboard use than the box type devices used with the loose leaf programs. Some of the masking devices are integral parts of the program while others are separate and can be used with other programs. Several companies publish programs in either the booklet form or the loose leaf type. The content is identical and neither form is superior in the learning process. The machine or device exists merely to manipulate the program, for it is the program that does the teaching; it is the program from which the student learns, it is the program which is the creative aspect of the process.[20] Above all, one thing must be clear--teaching machines do not teach. They merely present materials which have been developed or programmed in a special way.

While by no means the only ones available, the following devices are considered suitable for use aboard ship. Encyclopaedia Britannica's TEMAC (Figure 2), TMI-Grolier's Self-TUTOR (Figure 3), Dyna Slide Company's Vertimask or slide-a-mask (Figure 4), National Bank Books Company's Learn Ease (Figure 5), and the programmed textbook.

Through the remainder of the paper I will avoid the use of the phrase "teaching machine." This phrase has been carried over from the early stages of development of the first machines used in programmed instruction. (Figures 6-13). It calls to mind large boxes and gadgets which is very misleading. This connotation is particularly harmful when considering shipboard use where size and ease of handling is of utmost importance. Usually the word machine carries with it an implication of a device the size of a portable typewriter or larger. This immediately

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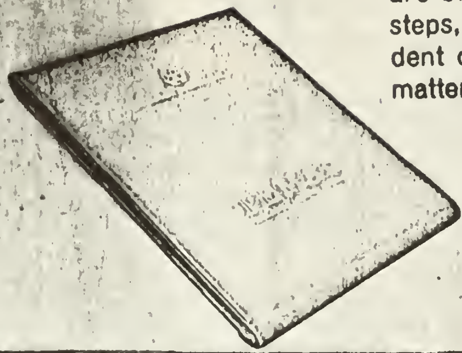
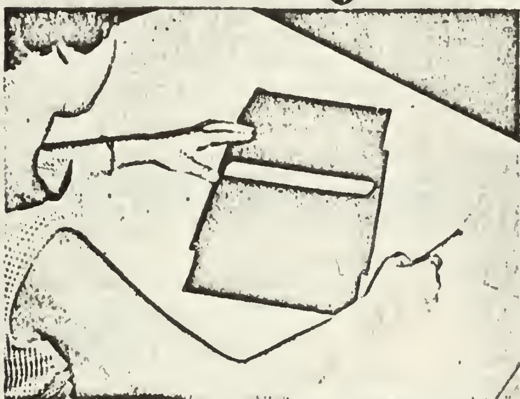
[20]Finn, _op_. _cit_., p. 10.

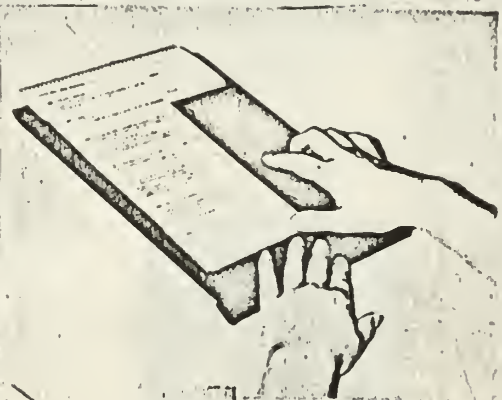
sets up a resistance, very often difficult to overcome, for utilization aboard ship.

TEMAC Programmed Learning Materials are broken down into small, sequential steps, carefully designed to give the student comprehension of the basic subjec matter.

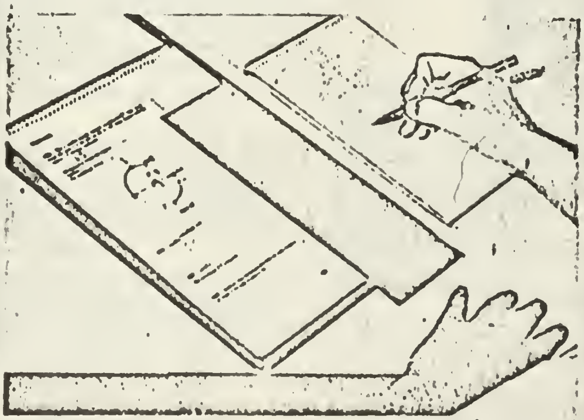




She is systematically asked questions about each new piece of information she acquires. Moving at her own pace, with immediate answers to check her learning progress, she gains psychological "reinforcement" every step of the way.



By using a moveable masking device, the student checks the accuracy of her response through each step of the learning process. (Two masks are used for TEMAC language courses—a single mask for TEMAC mathematics courses.)



Encyclopaedia Brittanica Films: TEMAC

Program designed for use in special folder with integral sliding mask. Student responds on separate answer sheet, then compares his answer with the one provided.

(Figure 2)

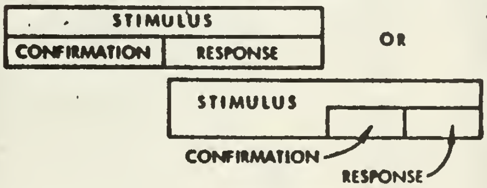
TMI-GROLIER

SELF-TUTOR

OPERATING INSTRUCTIONS

You are about to begin a new adventure in learning. These instructions tell you how to use your TMI-Grolier Self-Tutor and how to help others to use it.

1. **Open the Self-Tutor to the position shown in figure 1.**
2. **Note that the mask (figure 1) is attached to the right side of the Self-Tutor by means of a plastic guide. By sliding the mask along this guide, the instruction frames will be visible through the window.**
3. **Lift the mask and fold it over to the right, exposing a slit on the left side and a strap at the top. A hidden slit holds the answer pad (figures 1 and 2). The strap holds top-bound textbooks (figure 1) and the vertical slit holds side-bound textbooks (figure 2). Insert only the back covers of the textbook into the slit or strap, in the same manner as the answer pad.**
4. **Turn the Rotating Flap to the appropriate window position indicated on the title page of your TMI-Grolier self-tutoring course.**
5. **Find frame 1 on the first page of your program and slide the mask up until the window is over that frame. Your mask should be in the position shown in figure 2. Check that the Rotating Flap is in the proper position for your program.**
6. **Notice that each frame is divided into three parts; stimulus, response and confirmation.**



7. **When your mask is properly positioned, the stimulus and response areas are exposed, and the confirmation area is covered.**
8. **In the stimulus space you will find information and questions. Write your answer either in the response area or on the corresponding section of the answer pad.**
9. **Now slide the mask down and check your answer against the correct answer in the confirmation space.**
10. **Slide the mask down and work the next frame in the same manner.**
11. **When you have completed the last frame on the page, flip the mask to the right and turn to the next page.**
12. **Flip the mask back to the left and move it up to the first frame on that page. Continue following the succeeding numbered frames and sections in the same manner until you come to the back of the textbook.**
13. **Now slide your textbook out of the Self-Tutor. Turn the textbook around and insert the front cover into the same slit or strap in the Self-Tutor. Continue working the succeeding numbered frames in the same manner until you have completed the course.**

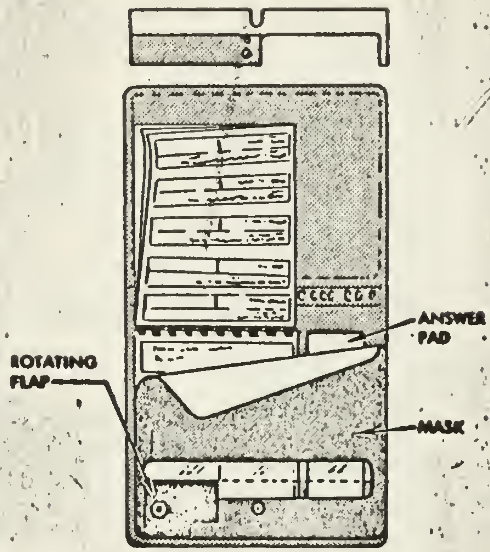


Figure 1. Rotating Flap - Window #2 Position.

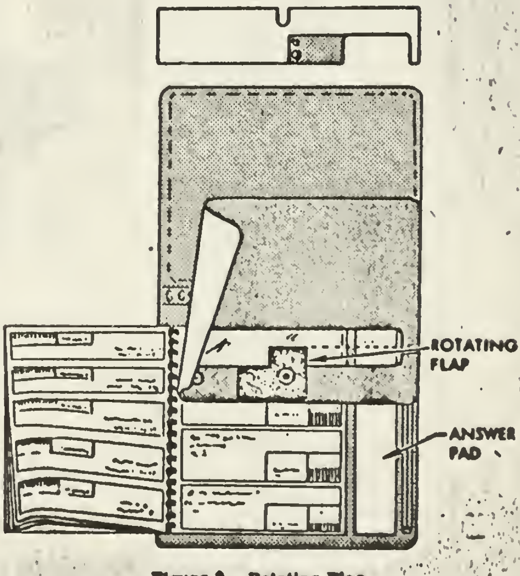
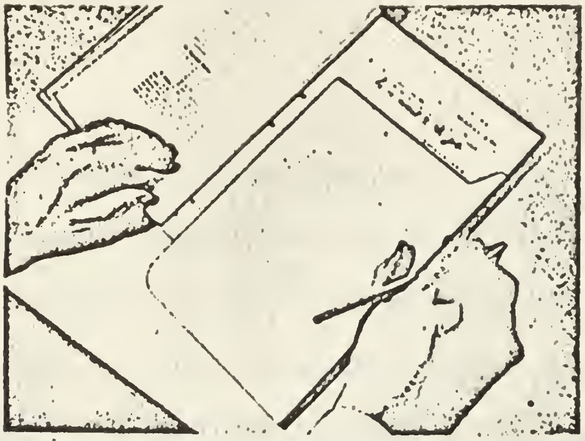


Figure 2. Rotating Flap - Window #1 Position.

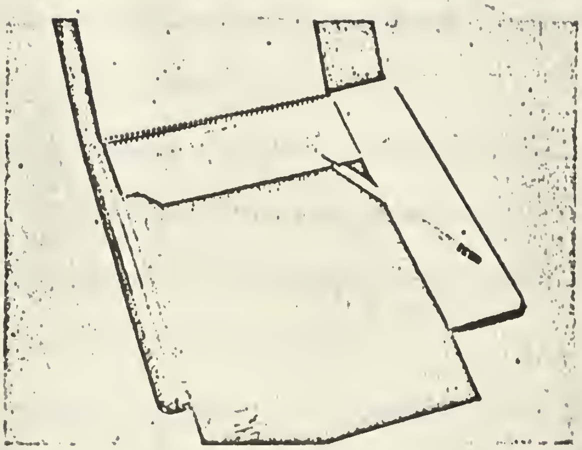
(Figure 3)



Dyna Slide Co.: VERTIMASK
SLIDE-A-MASK

The student uses either of these devices to unmask the program at his own rate.

(Figure 4)



National Blank Book Co.: LEARN EASE

Folders and binders for programed learning materials with mask on sliding track. Can be made to open at side or end.

(Figure 5)

III

RESEARCH AND DEVELOPMENT IN THE NAVY

1. Research

Early research in the area of programmed instruction was done mostly by the Special Devices Section of the Bureau of Aeronautics. This section later became the present U. S. Naval Training Devices Center. The Navy's research, dating back to 1942, followed generally that of all other research in the field, putting major emphasis on the hardware with little or no emphasis on the program. For this reason developments during the period 1942-56 were limited mainly to large, elaborate, usually electrical training devices to be used at shore based training facilities. The Training Devices Center, along with numerous other naval activities made the transition from machine to program emphasis and since 1960 considerable research in the area of programming and modern programmed instruction has been conducted. (see Appendix I)

Devices developed during the early period of research include the Automated Rater, the Study Card Set, the Punchboard Tutor, the Drum Rater, the Green Light Rater, the Skinner Disk Machine, the Multiple Sensory Trainer and the Multi-Film Rater.

It should be noted here that these devices have no relationship to those used in connection with the programmed instruction being considered for utilization aboard ship. The purpose and function of the two types of devices are completely different even though they are both commonly referred to as "teaching machines." A brief description of these devices will be given to point out the extreme difference between them and the

ones illustrated in chapter two.

The Automatic Rater, Device 503 (Fig. 6) is used in testing a person's knowledge in various fields and his aptitude for sight recognition of objects or subjects. It presents the questions visually along with up to seven answers, of which only one is correct. The Study Card Sets are paper and pencil devices used to teach trouble-shooting techniques. The set is made up of a schematic wiring diagram, a corresponding pictorial wiring diagram for circuits being studied and a separate work sheet for each trouble-shooting problem. The work sheet is shown in figure 7. The Punchboard Tutor, Device 20-E2e (Fig. 8) is also a paper and pencil device for individual use. It can be used either for training or for testing. The board, which contains 40 rows of four holes each, is used in conjunction with a set of multiple-choice questions designed for the punchboard. The Drum Rater (Fig. 9) is used to present a question with four multiple-choice answers. The trainee indicates his answer by pressing one of the four buttons, if it is correct the next card is presented. If an incorrect answer is selected the card does not move and an error is recorded by an attached counter. The Green Light Rater (Fig. 10) presents 48 question cards with four answer buttons under each card. Pressing the correct button makes a green light glow; pressing the incorrect button activates a red light. The device is 31" long, 43" wide, and 6" deep. The Skinner Disk Machine, Device 11H7 (Fig. 11) was developed by B. F. Skinner. A sequence of statements interspersed with blanks is printed on 30 radial segments on a 12-inch paper disk, and the disk is fitted into the machine. The student writes his response on a paper strip under the right window.

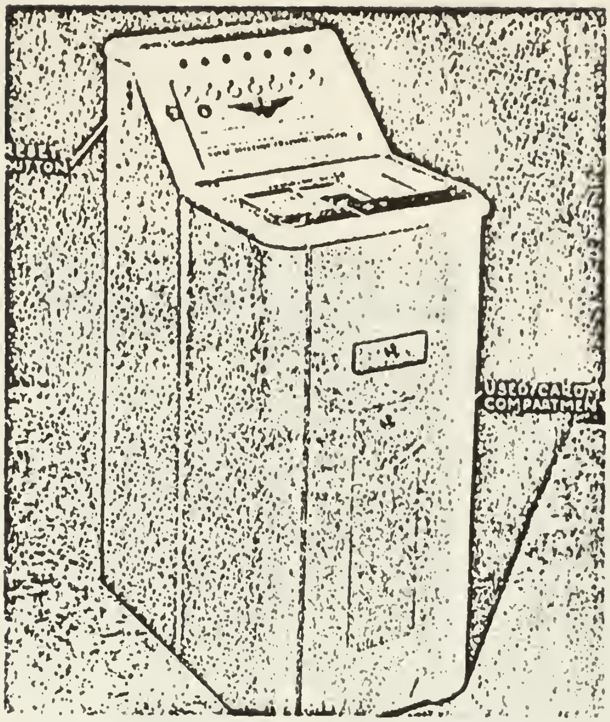


Figure 6. Front view of Automatic Rater.

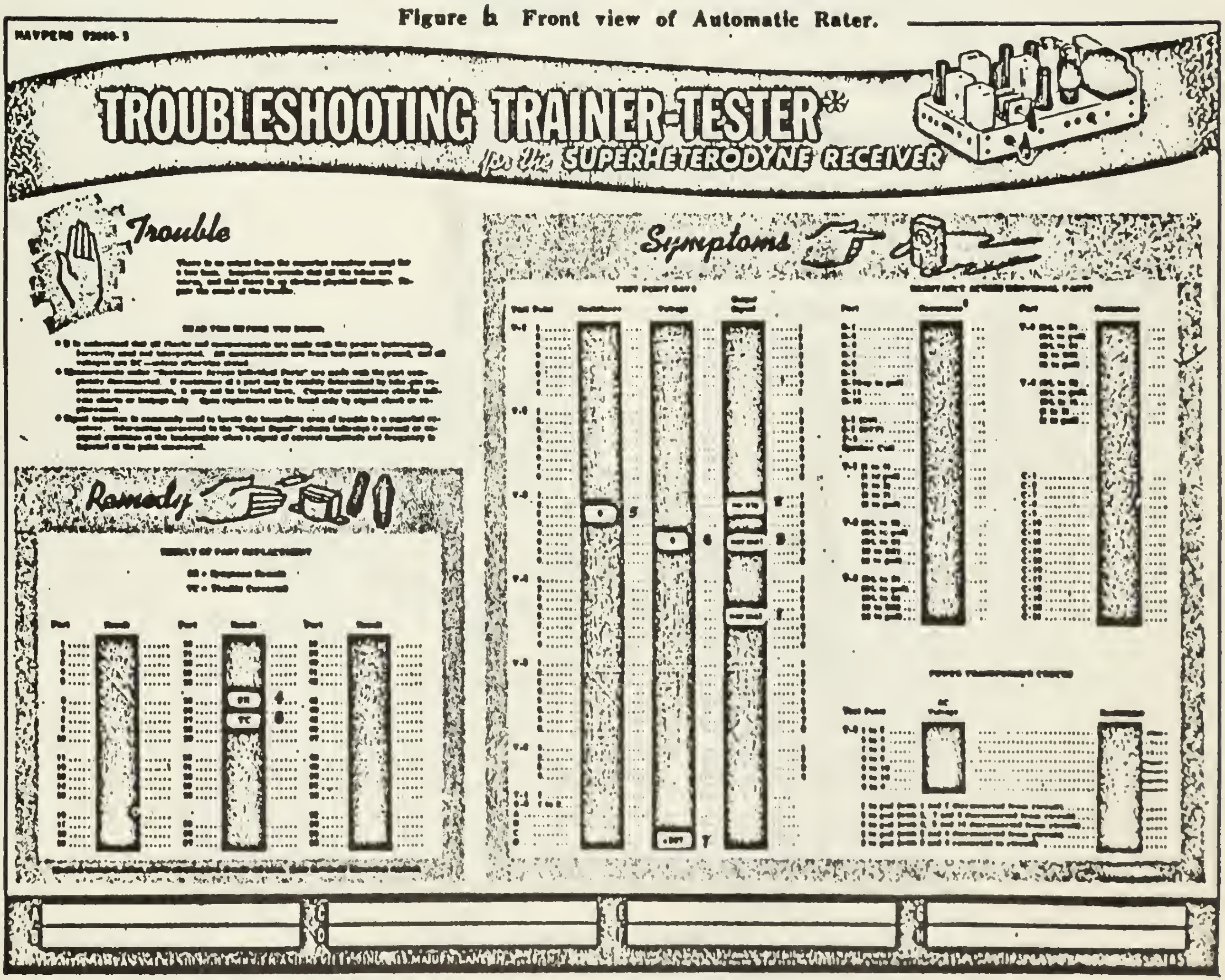


Figure 7. Sample troubleshooting work sheet.

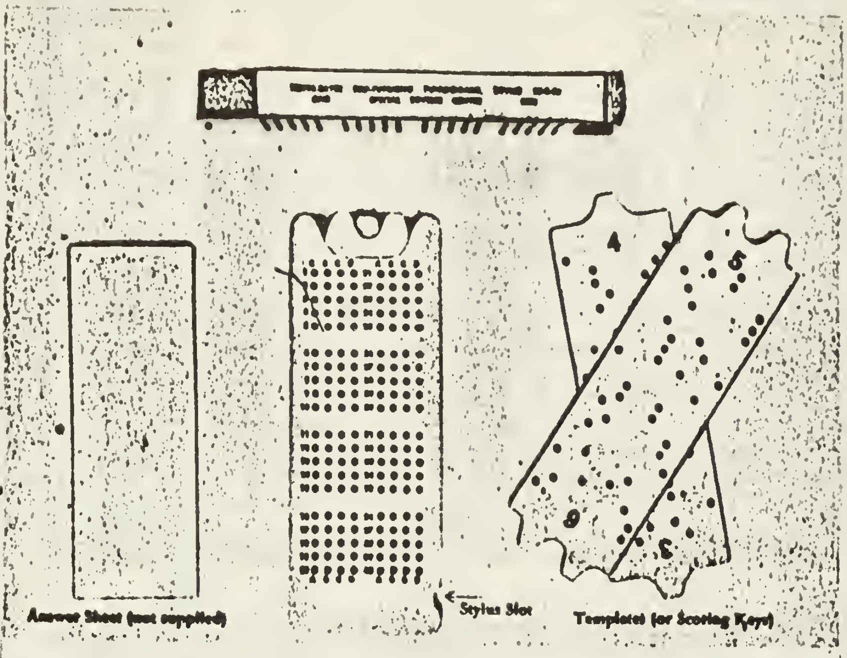


Figure 8. The Punchboard Tutor—one of the simplest and least expensive of the teach-test training devices.

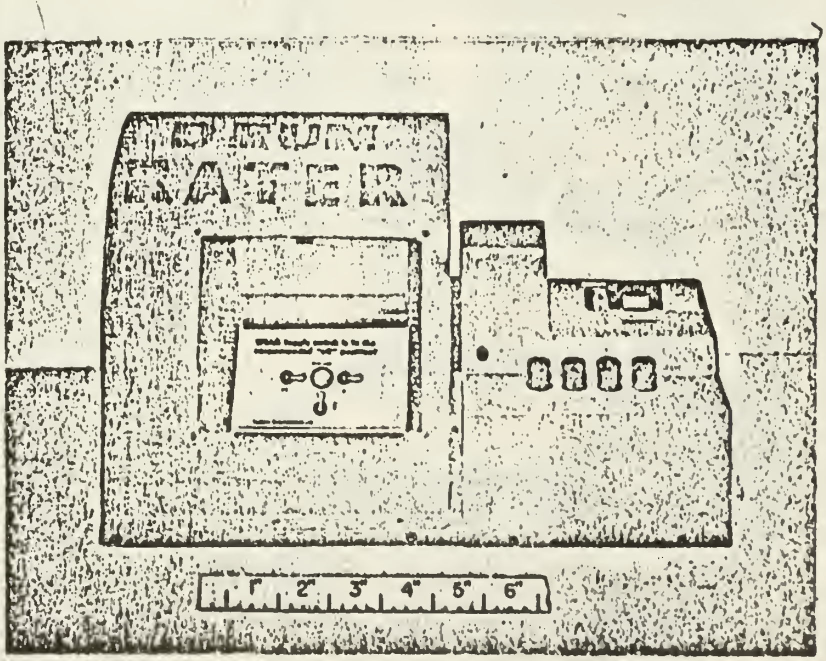


Figure 9. The Drum Rater.

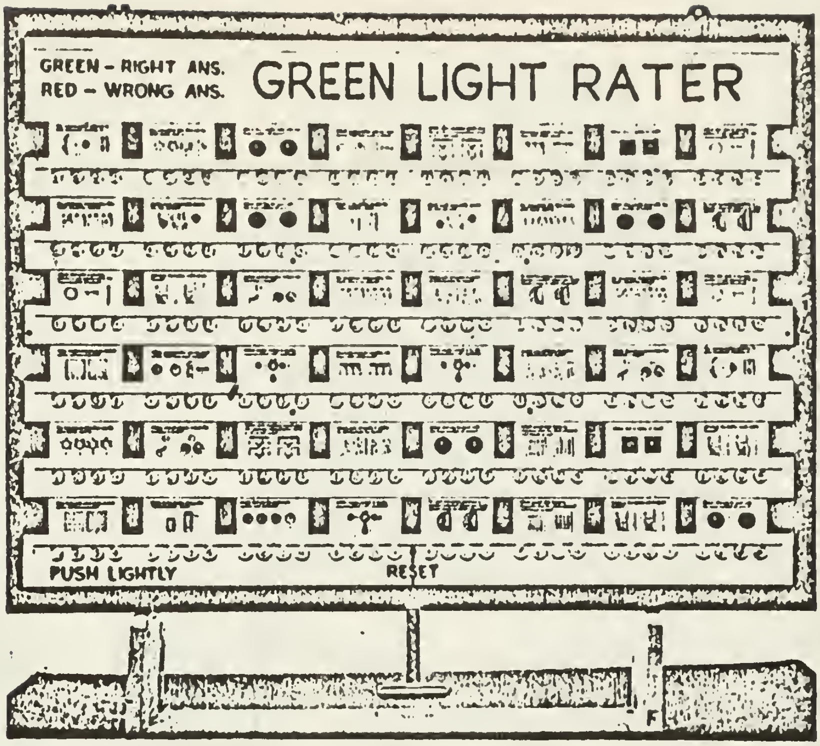


Figure 10. The Green Light Rater.

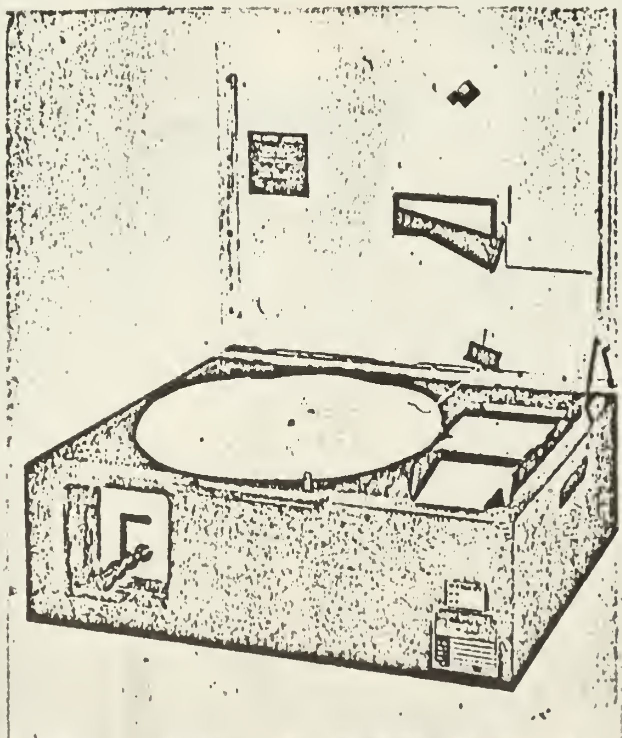


Figure 11. Skinner Disk Machine, Device 11H7.

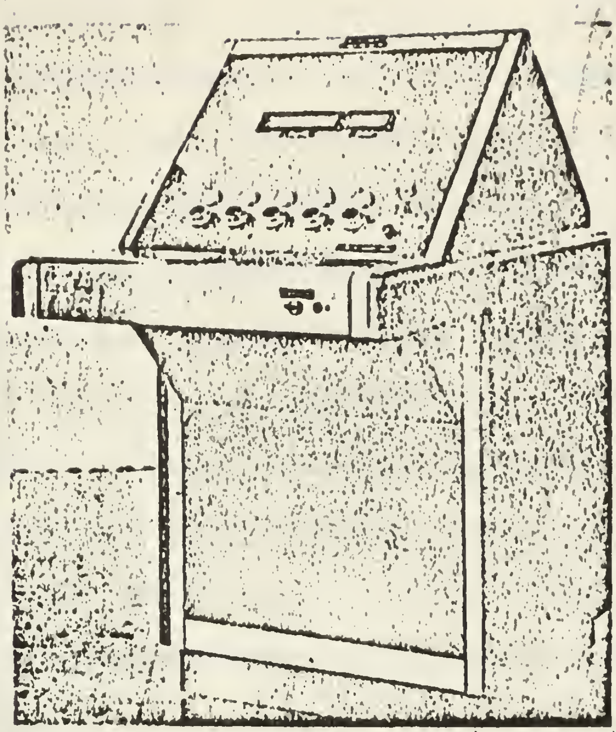


Figure 12. Multiple Sensory Trainer, Device 11H20.

Figure/3. Multi-Film Rater, Device 28C8

By lifting the lever on the front of the machine, he moves what he has written under a plexiglass plate and simultaneously retracts the shutter plate under the left window revealing the correct response. The Multiple Sensory Trainer, Device 11H20 (Fig. 12) presents material either visually in the "questions" window, or aurally, or both. The student constructs his response by writing it in the window provided on tape, or by speaking it into the tape recorder. There is no automatic scoring feature but immediate knowledge of results is provided by requiring the trainee to evaluate his answer against the correct answer which the machine indicates either visually, aurally, or both. The Multi-Film Rater, Device 28C8 (Fig. 13) presents instructional material on a wide variety of subjects through multiple-choice questions; provides the proper answer; and automatically records a score based on the speed of the selection of the right answer.[21]

A chronological review of research and application of programmed instructional materials in the Navy since 1960 is given in Appendix I. This review may not be all inclusive, however, it is believed that the major work is covered. ONR Technical Report No. 28 gives an exhaustive review of research and written material on programmed instruction, along with a description of devices developed prior to 1960. (12) This report was the by-product of Technical Report No. 29 which is the report of a study made by the same individuals into the potential usefulness of teaching machines for training personnel to maintain and to operate

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[21]Clayton K. Bishop, "A Survey of Devices and Research in Programed Learning," Training Device Development, NAVEXOS P-1300-29, (Port Washington: U. S. Naval Training Devices Center, 1962), pp. 27-33.

electronically sophisticated systems in the Navy.

2. Present fleet utilization.

The policy of the Bureau of Naval Personnel is set forth in BUPERSINST 1500.50A. (20) While the Chief of Naval Personnel is aware and recognizes the possible application of programmed instruction, a general wait and see policy is being followed. Experiments, research, and observations of results of programs conducted both within and outside of the Navy are, however, being continued.

The above instruction listed four factors other than the gains in learning provided by programmed instruction which must be considered. 1) Automatic type devices are very costly and the more inexpensive, less complex types serve nothing more than merely a book holder. 2) A bulk of material in the order of eight to ten times that of the conventional book covering the same subject matter is commonplace. 3) The time for writing and validation of programs frequently exceeds three years. For some technical subjects where the content, of necessity, changes rapidly, a course could be outdated before it is completed. 4) To date, costs of programming material in all forms have been very high, both in terms of funds and personnel requirements. It was further stated that experience gained thus far has indicated that programmed instruction material is not so far superior to other instructional material as to warrant its general and widespread use in the Navy.

These observations are not altogether valid when considering utilization in shipboard training programs. As was mentioned in the introduction, this new technique is not a cure-all for every situation. It is not intended for arbitrary, general, and widespread application. It is suggested, however, that there are specific areas of shipboard

training and education where its use can effectively and efficiently be made. The primary function of the device is actually nothing more than a mask or bookholder for those programs most applicable to fleet use. Most of these programs are in booklet form and seldom larger than the average 8½ x 11 inch NAVPERS training manual. Numerous low cost commercial programs are available which can be used very effectively in shipboard training, particularly as prerequisite training for fleet and BuPers schools. Some degree of obsolescence at time of publication can be said of most of today's technical publications.

Some fleet schools and fleet training facilities have taken more positive steps toward the use of programmed instruction in their training programs. Commander Training Command, U. S. Atlantic Fleet and the U. S. Fleet Submarine Training Facility, Pearl Harbor, have independently taken the first steps to utilize the programmed instruction technology for training of personnel aboard ships. There are undoubtedly other fleet commands and activities using programmed instruction in varying degrees. The above mentioned were the only ones found to be actively engaged in its application. Numerous shore activities and academic institutions are using commercially published programs as well as some in-house developed ones.

Most of the courses used in the program of Training Command, Atlantic Fleet are at the shore based schools. Fleet Training Center, Newport, produced the courses <u>Basic Maneuvering</u> and <u>Advanced Maneuvering Board</u> which are now being published by BuPers. Several commercially produced programmed courses are being used at several of the schools.

Of major significance is the in-house capability to program at Fleet Training Center, Newport. A Program Training Unit has been established which conducts a four-week course in programming techniques. The second class convened on 2 March 1964. It is the plan of TRALANT to develop programmed courses which can be used in training centers to cut training time for fleet training ashore, but more important for the use of prerequisite training to be used by personnel aboard ship prior to going to fleet schools ashore. An ultimate goal is to move some of the courses now taught at fleet training activities back aboard ship. It is anticipated that courses in Basic ASW for Destroyer Types, Basic Damage Control, Battery Alignment, and Radio-Telegraph Procedure (Supervision) will be proposed by students and school personnel by the latter part of 1964. Also being developed is a course for instruction of shipboard personnel in data collection for the Standard Navy Maintenance Management Program. This course is being prepared by members of the Fleet Work Study Group along with personnel of the Programed Instruction Center.

The first programmed course used at the training center was produced by the Raytheon Company. This course deals with message format and is used in the six-week Visual Signaling Course. It was initially validated at the Fleet Training Center and on the eight destroyers of Destroyer Flotilla Four. Results of the program administered aboard the ships are given in (Fig. 14).

The Fleet Submarine Training Facility has been working with programmed instructional devices for the Pearl Harbor based submarines for the past 18 months. A central library of commercial programmed courses is maintained at the base information and education office.

Their library now consists of some twenty-six different courses including one course in U. S. Constitution programmed by personnel at the base. There are several copies of the more popular courses. Personnel aboard the submarines and those attached to the training facility have access to the courses just as they would have to conventional training course books.

This facility of programmed instruction has been provided by an initial investment of about $150 and a total outlay of only $600. The program has met with outstanding success and the courses are in constant demand. After the first six month of operation, 75 courses had been checked out. Of these 44 had been returned of which 41 were completed satisfactorily.

EXPERIMENTAL EVALUATION OF SELF*INSTRUCTIONAL PROGRAM ON NAVAL MESSAGE FORMAT

Name	Years of Education	GCT/ARI Average	GCT/CLER Average	Where Administered	Score on pre-test with self-instructional prgm. in naval message format	Score on post-test with self-instructional prgm. in naval message format
GAFFEY, T.H.	13	61.5	59.5	USS DUPONT	1.0	2.6
JONES, W.T.	12	48.6	53.5	USS DUPONT	1.8	2.6
WINTER, J.M.	12	55.0	51.5	USS SHENANDOAH	1.2	3.0
PUNCHARD, J.C.	10	51.0	49.0	USS STORMES	1.6	3.8
PETERSON, L.C.	9	39.0	55.0	USS TIDEWATER	---	2.6
BRADWELL, R.A.	9	50.0	27.0	USS CONWAY	.8	1.4
WARNER, R.F.	12	54.5	50.5	USS CONY	3.4	3.6
HOYT, J.B., JR	11	43.5	45.0	USS CONY	2.6	3.2
BEHNKE, J.C.	12	63.0	32.5	USS BACHE	1.8	3.4
STEVENS, D.L.	12	51.5	54.0	USS BEALE	---	3.8
TOTTY, T.J.	9	44.0	41.5	USS BEALE	---	3.8
MARTIN, D.	12	55.0	49.0	USS WILLARD KEITH	2.0	3.4
WALKER, H.	12	61.5	60.5	USS WILLARD KEITH	2.4	3.2

Figure 14

IV

SHIPBOARD APPLICATION

Programmed instruction can effectively be utilized in three basic areas in the shipboard training program. First, to provide prerequisite training for shore based schools. Second, to provide individual study in professional areas now provided exclusively by conventional correspondence courses. These programmed courses need not be used in place of, but rather in conjunction with, the conventional courses. Third, programmed instruction can be used very effectively in general development of the individual in non-professional, non-technical areas. Again, supplementing the existing library facilities and USAFI correspondence courses, which incidentaly seem to be ideal for programming.

1. Prerequisite training.

Normally shipboard training is divided into three separate and distinct catagories. One phase might be termed operational training. This includes those areas essential to the efficient operation and maintaining the operational readiness to carry out the primary mission of the ship. The second catagory can be called technical training, which includes those subjects which are designed to improve the maintenance and administration of the ship, its equipment and personnel.

The third and unfortunately often the most neglected area, I would like to call individual education. Here the individual develops the necessary basis or background on which to receive the training of the first two catagories. It is in this area that the individual must receive the theory and fundamental skills of his profession. keep abreast of the developments and maintain his professional proficiency.

In the past, virtually all of this basic education has been left up to the fleet and BuPers shore based schools. Almost without exception a few days to several weeks are spent in these schools with basic theory and principles of the particular subject being taught. This is particularly true in BuPers Class A, B, and C schools.

Some examples of this include the Electronic Technician School where considerable time is taken up with the teaching of basic mathematics. Many volunteers for the nuclear program require several weeks of intensive training in basic math at a shore activity before beginning the actual nuclear training. Basic theory of mechanics, electricity, steam, welding, etc., are given in each of the respective schools before getting into the skill being taught.

As the technical requirements increase with the development of more and more complex requirements, particularly in the areas involving nuclear application, most of these courses have been lengthened. The additional time being devoted to added instruction in theory.

This additional time required in shore based schools, leaves less time spent aboard ship and adds substantially to the ever-increasing personnel problems in the technical ratings.

Every effort should be made to provide as much of this basic training as possible aboard ship. The principles of programmed learning can be applied very effectively in providing much of this basic school prerequisite aboard ship before reporting to the school ashore. Numerous courses in math from basic mathematics through advanced calculus are available for those scheduled for school requiring a math background. Programmed instruction is particularly beneficial in the teaching of pure theory and fundamental skills. A potential student

armed with the basic knowledge gained through programmed instruction before reporting to school would require only a brief review of basic theory, thus requiring less classroom work and allowing more efficient use of the time spent ashore.

A possible program for this prerequisite training might be as follows: A man selected for a school would be sent programmed material developed by the school to study aboard ship. This material would be those basic principles usually taught during the first one to three weeks of the school. The individual should be allowed one or two hours each day during working hours to work on the material. Upon completion of this course of instruction the individual should be given a pre-course exam to ensure that he has attained the basic requirements for the course concerned. This portion of the course could then be eliminated from the curriculum except for possibly a short refresher during the first day or two of class.

2. Professional study.

Many of the Navy enlisted correspondence courses lend themselves well to modification for use in programmed instruction. The material in the course books for Basic Military Requirements, Fireman, and Seaman, seem particularly adaptable to programming. The advantages would be that it would not take as long to complete the course, with at least equal results. Further, the trainee, in most cases would enjoy the work much more than apparently is now the case. The present textbooks could be used in conjunction with the programmed material to provide pictures, charts and additional reference. The presently employed end-of-course test can continue to be used to test the individual's readiness for advancement.

An in-house programming capacity could be developed to program this material, expanding as rapidly as possible to the other courses which could more effectively be given in programmed form.

3. General development.

The command also must not neglect its responsibility in encouraging the continued academic development of the individual, his role as a citizen of this country, and his part in the ever-increasing people to people program.

Again programmed instruction can provide for much of this training. Several very good courses in U. S. Constitution, government, history, foreign languages, English, spelling, etc., are available at very reasonable costs through commercial firms.

4. Summary.

In summary, much of the preliminary theory now taught in Navy A, B, and C schools and fleet schools ashore can and should be taught aboard ship through the use of programmed instruction. Subjects such as math, pre-nuclear math and physics, basic theory of mechanics, electricity, steam, etc., can all effectively be taught aboard ship using programmed devices. Many of the Navy correspondence courses as well as USAFI courses seem to lend themselves well to modification for use in programmed instruction. Numerous commercial courses are presently available at very reasonable costs which could be utilized immediately in the general academic development of the individual.

The potential of this learning technique appears almost unlimited for application throughout the Navy's training and education program. Every effort should be made to take full advantage of present applications and a continued effort to find new areas where programmed instruction

can effectively and efficiently be applied.

V

CONCLUSIONS

The primary purpose of the training program of the Navy should be toward the development of each individual to his maximum potential. This includes keeping each one's academic preparation adequate to the task of learning and performing increasingly complex military functions. To accomplish this aim we must seek to maintain the highest standard and the most efficient methods of education available.

The responsibility of maintaining this high standard and efficient methods for fleet training rests primarily on the shoulders of the ship commanders. While the ship's commanding officer is responsible for the over-all training of his crew, he can and should share the work of the training with shore based training facilities. He must develop his training program to accomplish the maximum amount with the material and time he has aboard ship; then obtain the rest of the training requirements from ashore facilities. This will not only reduce the cost of administering the shore based training facilities but will also reduce the time each individual must spend away from the ship, thus providing a more efficient over-all training program.

Programmed instruction can make a major contribution toward achieving a more efficient shipboard training and education program. By providing much of the basic theory and principles through programmed instruction, the commanding officer can assume a greater portion of the training requirements and at the same time retain the services of the individual aboard ship.

Even if programmed instruction produces the same level of performance with no significant difference in the results of this technique and the traditional methods of instruction there are still very good reasons to use programmed instruction whenever possible.

One consistent finding in studies is that programmed instruction speeds learning. The savings in time can be used profitably in naval training either by shortening ashore courses or providing additional training. A reduction in time required for the present instruction will result in either a reduction in cost or increased training for the same cost.

Another advantage, particularly in school prerequisite instruction, is the consistency of the program, each individual is assured of getting the same material. Several studies have indicated a leveling effect within a group, especially in bringing the lower aptitude portion up closer to the group average.[22] Programmed instruction, by its design provides a great deal of motivation beyond that supplied by conventional materials and its individuality solves many scheduling problems.

I have attempted to present a brief summary of the development of programmed instruction and provide some areas in which this new technique can profitably be used in the naval shipboard training program. I have just scratched the surface of possible application of programmed instruction in naval training programs.

Only one thing is certain. No matter what the potentialities of

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[22] Lloyd E. Homme, Robert E. Willey, William H. McMahan, A Study In The Applications of Teaching Machines, NAVTRADEVCEN 1000-1, (Port Washington: U. S. Naval Training Devices Center, 1962), p. ii.

this technique may be, it is merely a tool. It will be only as good or as bad as the uses to which it is put.

BIBLIOGRAPHY

1. Beltran, Alfred A. (comp.). Automated Teaching Machines: An Annotated Bibliography. Sunnyvale: Lockheed Aircraft Corporation, 1960.

2. Bishop, Clayton K. "A Survey of Devices and Research in Programed Learning." Training Device Developments - NAVEXOS P-1300-29. Port Washington, N. Y.: U. S. Naval Training Devices Center, 1962. pp. 26-35.

3. Blood, Jerome W. (ed.). Programed Instruction in Industry (AMA Bulleton No. 22). New York: American Management Association, Inc., 1962.

4. Brethower, Dale M., Programed Instruction. Chicago: Educational Methods, 1963.

5. Carlson, Paul. Guide to Programmed Teaching. Albuquerque: General Programmed Teaching Corp., 1963.

6. Compere, Tom (ed.). The Navy Blue Book, Volume 1. Indianapolis: Bobbs-Merrill Company, Inc., 1960.

7. Coulson, John E. (ed.). Programed Learning and Computer Based Instruction. New York: John Wiley and Sons, Inc., 1962.

8. Dolmatch, Theodore B., Elizabeth Marting, and Robert E. Finley (eds.). Revolution in Training: Programed Instruction in Industry. New York: American Management Association, 1962.

9. Fine, Benjamin. The Modern Family Guide to Education. Garden City, N. Y.: Doubleday and Company, Inc., 1962.

10. Finn, James D. and Donald C. Perrin. Teaching Machines and Programed Learning, 1962: A Survey of the Industry (TDP Occasional Paper No. 3). Washington, D. C.: National Education Association, 1962. Reprintedbby U. S. Government Printing Office for U. S. Department of Health, Education, and Welfare, Office of Education, 1962.

11. Fry, Edward B. Teaching Machines and Programed Instruction. New York: McGraw-Hill Book Company, Inc., 1963.

12. Fry, Edward B., Glenn L. Bryan, and Joseph W. Rigney. Teaching Machines: An Annotated Bibliography. ONR Technical Report No. 28 Prepared for Office of Naval Research by Department of Psychology, University of Southern California, 1959.

13. Green, E. J. The Learning Process and Programmed Instruction. New York: Holt, Rinehart, and Winston, 1962.

14. Hilgard, Ernest R. Theories of Learning. Second edition. New York: Appleton-Century-Crofts, Inc., 1956.

15. Homme, Lloyd E., Robert E. Willey, and William H. McMahan. "A Study in the Application of Teaching Machines," Technical Report: NAVTRADEVCEN 1000-1. Prepared for U. S. Naval Training Devices Center by Teaching Machines, Inc., Albuquerque, New Mexico, 1962.

16. Lang. J. C. "Instructional Problems in Navy Education and Training," Naval Training Bulletin, Summer-Fall 1962, pp. 10-12.

17. Paul, Norman S. "Education and The Armed Forces," Naval Training Bulletin, Winter 1963, pp. 6-7.

18. Programs, '62: A Guide to Programed Instruction Materials. Compiled and produced by The Center for Programed Instruction, Inc. Washington, D. C.: U. S. Government Printing Office, 1962.

19. "The Teaching Machine," Naval Training Bulletin, Spring 1961, pp. 5-8.

20. United States Bureau of Naval Personnel Instruction 1500.50A of 6 September 1963, Subject: Policies Concerning the Use of Programed Instruction.

21. United States Bureau of Naval Personnel, Personnel Research Memorandum, "The Potential for Automated Instruction in The FBM Training Program", 1962.

APPENDIX I

CHRONOLOGY OF EFFORTS DIRECTED IN THE RESEARCH
AND USE OF PROGRAMMED INSTRUCTIONAL MATERIALS
AND AUTOMATED TEACHING DEVICES IN THE U. S. NAVY

1960:

1. March: Naval Training Devices Center Technical Report 507-1. The Use of Context Cues in Teaching Machines. Contract N61339-507. Principal Investigator: Dr. Robert E. Silverman, Department of Psychology, New York University. Investigation of various methods of presenting verbal material in the use of teaching machines. Of special importance are the physical characteristics of printed verbal materials, and their interaction with the stimulus backgrounds on which they were printed. Isolating some items by making them vivid in respect to others facilitates learning.

2. June: Naval Training Devices Center Technical Report 507-2. Automated Teaching: A Review of Theory and Research. Contract N61339-507. Principal Investigator: Dr. Robert E. Silverman, Department of Psychology, New York University. A Critical survey of published studies in programmed learning. The review focused in sharp detail problems areas in respect to the paucity of well controlled studies.

3. July: Naval Training Devices Center contracted for the development of a linear program on basic principles of D. C. and A. C. electricity, based on VanValkenburgh-Neville series. The total price of the contract was approximately $38,000. The program was used on a trial basis at the Service School Command, Great Lakes. The results did not show any advantages or gains over conventional methods. It was indicated that

much of the material was either technically inaccurate or not appropriate. Pers-15 was requested to re-evaluate the material to see if it may have value with other groups. Certain portions of the program, based upon material found to give the trainee the most problems, has been rewritten and corrected.

<u>1961</u>:

4. January: Bureau of Naval Personnel. A programmed learning text using the branching technique was developed by Philco for Pers-C111. The total amount of the contract was $5,903. Subject matter was "Trouble-shooting Electronic Equipment." The purpose of the text is to provide trainees with a firm comprehension of the fundamentals of logical trouble-shooting that apply to any type or complexity of electronic equipment. Philco completed the project after 16 months of writing effort. The text was printed in November and received wide distribution. Since it was a self-learning text, it has a specific application as an instructional vehicle aboard ships.

5. January: Guided Missiles School, Dam Neck, purchased fifty copies of the <u>Arithmetic of Computers</u> by Norman Crowder for use in the Special Technology phase of IBM Technical Training at the school. An unofficial report indicated that the book provided an excellent review of math principles and covered phases of the classroom instruction in binary and octal systems. When used as a primer by the students for self study, instructors could cover the area in less time and a more advanced coverage of machine applications of the binary and octal systems was possible. A time savings of four classroom hours in enlisted classes on this subject was realized. No time was saved by officer classes.

This is probably accounted for by the bulk of other outside reading required of officer personnel. The book was used by the student for out of class study. The same material can be presented in class in less time than is required by reading the book.

6. February: Naval Training Devices Center Technical Report 661-1. Research in the Automation of Teaching. Contract N61339-661. Principal Investigator: Dr. Carl B. Zuckerman, Department of Psychology, Brooklyn College. Of three typical modes of responding, it was found that true-false was the least efficient, there being no difference between completion and multiple-choice. Also when comparing programs of basic electricity with 60 items or less there was no significant difference between random and sequential presentations. Finally, it was found that of four methods of presentations, the programmed text was most efficient, lecture next, programmed booklet third, and machine presentation fourth.

7. June: Naval Training Devices Center Technical Report 507-3. Response Mode, Pacing, and Motivational Effects in Teaching Machines. Contract N61339-507. Principal Investigator: Dr. Robert E. Silverman, Department of Psychology, New York University. The implications from this study was that pacing appears to be feasible and may serve to shorten learning time; type of response for low error rate programs may not be crucial; and a complex electromechanical machine as opposed to simpler types of teaching machines as such does not facilitate learning for short periods of time.

8. September: U. S. Naval Schools Command, Treasure Island. E. J. Willoughby, RDCS, USN prepared a scrambled book on the Basic Maneuvering Board. The book used both the branching and linear technique of

programming. Four trainees from the command were selected to take and test the course. An endorsement from the Commanding Officer, Naval Schools Command reports that the book is well organized and indicates that it is considered as a valuable teaching aid for in-service training or for use as a possible correspondence course.

9. October: Guided Missiles School, Dam Neck, purchased six AutoTutor Mark II teaching machines and four programmed course titles. The purpose of this trial was to determine if attrition could be reduced by the application of programmed materials for refresher and remedial training for waiting students with identified weaknesses in one or more of the following subject areas: Computer Math, Trigonometry, Basic Math, Basic Electricity, Introduction to Algebra and Study of the Oscilloscope. MT "A" School students awaiting instruction were pre-tested and those showing inadequate preparation were assigned one week of remedial instruction of five hours per day on the AutoTutor. A study of the course content and the math included in the programs in the machine revealed that off-the-shelf programs were not particularly pertinent to the curriculum requirements. A course of remedial math specific to the course requirements was devised and presented by conventional methods. Indications demonstrated more net gain in trainee performance in the MT "A" Course from trainees given conventional instruction specific to their needs in the MT "A" curriculum. Programmed material specific to the curriculum was not developed.

In November 100 copies of <u>Trigonometry</u>: <u>A Practical Course</u> by Crowder and Martin were ordered for use in the Special Technology Course. It was considered to be valuable for personnel whose background

in this subject was meager. It had negligible direct application to the course.

1962:

10. January: Service School Command, San Diego, California. The staff conducted a study using the Tutor Film, first year electronics and the Mark II AutoTutor to provide refresher training in electronics theory for personnel assigned to instructor duty in electronics and electricity. Results of first study indicated that this method may provide more effective in-service training for the instructors and reduce the time for breaking in new instructors. A more comprehensive study was planned for fiscal year 1963.

11. January: Fleet Training Center, Newport, Rhode Island. A 250 frame linear program covering the six hour portion of the six week class "A" Visual Signalling Course was used with one class. This course was prepared and conducted by Raytheon by a reciprocal arrangement at no cost to the Navy. The course was also administered aboard the eight destroyers of DESFLOT FOUR. Favorable results were reported from both activities.

12. January: Guided Missiles School, Dam Neck purchased an additional 47 copies of Computer Arithmetic for use with the Special Technology Course. Again in February another 280 copies were obtained.

13. February: U. S. Naval Supply Corps School, Athens, Georgia. A programmed course book using the linear technique was developed by Entelek Incorporated of Newburyport, Massachusetts for BuSandA. The total cost of this contract was $40,000. The first field test was implemented at the Supply Corps School in February. An interim report

[illegible]

indicated that the achievement of trainees in this program was at a minimum equal to that of trainees taught the same material by conventional methods. It was indicated that programmed instruction could reduce the number of instructors required and may provide some savings in training time. It was concluded that the courses would require a revision before a more comprehensive study could be conducted.

14. April: Naval Training Devices Center Technical Report 789-1. Learning to Identify Nonverbal Sounds. An Application of a Computer as a Teaching Machine. Contract N61339-789. Principal Investigator: Dr. John A. Swets, Bolt, Beranek and Newman, Inc., Cambridge, Massachusetts. Four experiments were conducted in the area of auditory learning. A series of multidimensional sounds was presented to college students acting as subjects. Their task was to identify certain of these sounds after a period of practice. Various techniques of programmed instruction were used during the practice periods and compared with conventional training methods. It was found that groups trained by means of teaching machine principles were not superior to those trained in conventional ways, and in certain instances were actually inferior in identifying non-verbal sounds. Because of the negative findings of this study two additional experiments were performed under the same contract. Results were reported in Technical Report 789-2, Further Experiments on Computer-Aided Learning of Sound Identification. In the first experiment the subject was allowed to choose, at any time, from several instructional procedures; also, he could regulate the introduction of new aspects of stimuli. The other experiment was like the first except that an oscilloscope and a light-pen were used in

place of a typewriter as a means of communication between computer and subject. Again the findings were negative, i.e., the technique of programmed instruction was found to be inferior to simpler techniques for paired-associate tasks with various kinds of material. Further experiments were conducted under the same contract substituting visual identification for the sound identification.

Additional studies under contract by the Naval Training Devices Center for which final reports were not available include: A Study of Step Size and Error Rate in Programed Instruction by Dr. David J. Klaus, American Institute for Research, Pittsburgh, Pennsylvania. Adaptive Training and Non-Verbal Behavior by Dr. Edwin M. Hudson, Otis Elevator Co., Brooklyn, New York. And an in-house project, Multiple Sensory Stimulation in Programed Instruction by Dr. Clayton Bishop.

Dr. Klaus' study deals with three areas of inquiry: (a) the establishment of guidelines in operational terms for manipulating size-of-step in the linear program independently of student performance; (b) the investigation of mediating variables, principally error rate, which are thought to be related to both program characteristics, such as size-of-step, and measures of program effectiveness, such as achievement; (c) investigation of the impact of variations of size-of-step on achievement and time measures obtained from using the program in a test situation.

Using the Otis adaptive tracking simulator, Dr. Hudson investigated the effectiveness of simulation systems having various adaptive properties. Parameters and their effects were to be determined in the acquisition of various skill behaviors so as to keep automatically the trainee working

at an appropriate level of difficulty.

Dr. Bishop utilized Device 11H20, Multiple Sensory Trainer (Fig. 12, page 27) to investigate the relative effectiveness of (a) auditory, (b) visual, and (c) combined audio-visual presentation. The mode of response was either write, speak, or write and speak. The program used was Atomic Physics. Each of the 90 subjects were given approximately seven hours to learn. Measurement of the dependent variables consists of number of errors made in a given number of trials plus retention tests given after certain learning trials.

15. May: Service School Command, San Diego, California. An experiment using the programmed course book for the Navy Retail Sales course was conducted as a part of the 12-week Storekeeper Class "A" course. Reports indicated that this method may have some value for use in parts of the course, but indicated that it does not appear that the entire Storekeeper course could be programmed.

16. June: U. S. Naval Dental School, Naval Medical Center, Bethesda, Maryland. A Chief Dental Technician was sent to a two-week programmer course conducted at the Teachers College, Columbia University. The Dental School planned to experiment with the in-house programming of portions of the Dental Technician courses and study the feasibility of programming the officers correspondence extension courses. Results of these experiments, if completed, were not available.

17. August: Service School Command, Great Lakes, Illinois. Two instructors from the ET "A" School, Great Lakes attended a Programmed Learning Techniques course at Randolph Air Force Base, Texas. Personnel attending were taught the principles of and received some

practice in developing programmed learning material. Upon returning to the ET "A" School, the two instructors programmed portions of the AC Electricity fundamentals that had been found difficult to teach. A secondary purpose of this project was to determine the feasibility of the ET "A" School to develop an in-house capability of developing additional material of this nature.

18. October: Bureau of Naval Personnel. The first Naval course to teach personnel the techniques and procedures of developing programmed instructional materials was conducted by Federal Electric Corporation, Paramus, New Jersey. The course was conducted at the Fleet Training Center, U. S. Naval Station, Newport, Rhode Island. The main purpose of this course was to provide the Navy a curriculum for programmed instruction techniques. Twelve selected students, including officers, enlisted personnel and civilians, were taught the pilot curriculum and given a thorough grounding in the basic knowledge, information, skills, and techniques of programmed instruction. These people were a sampling of various training activities, coming from ComTraLant, BuMed, BuSandA, and BuPers. They became the nucleus of Navy personnel qualified to program.

BuPers did not continue with programmer training, however, Commander, Training Command, Atlantic Fleet established a Program Training Unit at Fleet Training Center, Newport, in the latter part of 1963. A four-weeks course in programming techniques is conducted by the Training Unit.

<u>1963</u>:

19. February: Bureau of Naval Personnel. The Chief of Naval Personnel (Pers-15) contracted with McGraw-Hill for development of

programmed instruction for purposes of feasibility, reliability and efficiency studies. Subject matter topics were Boolean algebra, physics, inertial navigation, transistors and circuit analysis. Results were not available.

20. Fleet ASW School, San Diego, California. A math course dealing with the related math for the ASW courses was programmed by the school staff in cooperation with the Chief of Naval Personnel (Pers-15). This material was to be field tested during the summer of 1963. Results were not available.

21. U. S. Naval Air Technical Training has had underway, since June 1961, an evaluation of teaching machines and programmed learning. The initial evaluation has been centered on the review of available information on programmed instruction. Since February 1962, a research in the use of programmed instruction has been conducted in the remedial night school of the Avionics Fundamentals School, Class "A". This is a linear D. C. electronics course programmed under a Navy research contract and a non-linear program under an Air Force contract. The Chief of Naval Air Technical Training conducted a study involving the use of a device called the Classroom Communicator which accomplishes many of the functions of the teaching machine and at the same time is suitable for use with study groups as large as 30 trainees.

22. U. S. Naval Training Aids Center, Treasure Island, San Francisco has for the past few years conducted seminars on the subject of programmed instruction and teaching machines for interested personnel from various Navy activities in the San Francisco area. Discussion leaders have been selected from persons engaged in the field, from

military activities and commercial firms. The purpose of these seminars has been to discuss the techniques and application of programmed instruction materials and demonstrate the use of automated teaching devices. They feel the potential for programmed instruction is tremendous in the area of Naval training and education.

23. The Fleet Submarine Training Facility, Pearl Harbor, has been utilizing programmed instruction since early 1963. These devices are used both in the base and shipboard training programs. Excellent results have been achieved and they are continuing to expand their program both in scope and depth.

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